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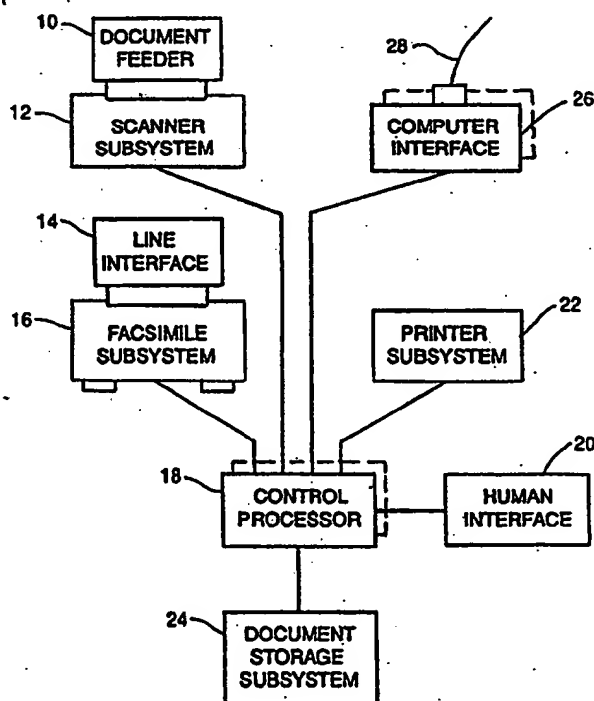
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(54) Title: **MULTI-FUNCTIONAL DOCUMENT PROCESSING SYSTEM INCLUDING FACSIMILE, SCANNER, PRINTER, AND DOCUMENT STORAGE**

(57) Abstract

A multi-functional document processing system has a scanner subsystem (12), a facsimile transmitter and receiver subsystem (16), a printer subsystem (22), and a document storage subsystem (24). A control processor (18) includes means for controlling each subsystem and performs a plurality of functions including transmitting and receiving documents using the facsimile, scanning documents, printing documents, copying documents, and storing documents. When a document is generated by one of the plurality of functions, the generated document is stored into a document memory (34) of the document storage subsystem (24). The generated document is maintained in the document storage (24). The stored documents are selectably retrievable any number of times to be processed by one or more of the subsystems.



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**MULTI-FUNCTIONAL DOCUMENT PROCESSING SYSTEM INCLUDING
FACSIMILE, SCANNER, PRINTER, AND DOCUMENT STORAGE**

Background of the Invention

The present invention relates to the art of document processing. It finds particular application in conjunction with multi-functional document processing systems having facsimile, scanning, printing, and copying functions and will be described with particular reference thereto.

A typical office requires a facsimile machine, a copier, and a printer. These machines are normally found as stand-alone equipment which operate in their own environment. Efforts in providing more efficient and convenient machines has led into combining the fax, printer and copier into one machine.

Although combining these functions seemed to simplify the office equipment environment, it created disadvantages. Limited resources and poor processing technology caused poor response time, competition for resources and prohibited true multi-tasking capabilities. Furthermore, lack of a document storage subsystem required a user to repeatably input a document if the document was to be processed at different times.

In a facsimile transmission operation, a document to be transmitted is scanned and converted into a series of electrical signals. These signals are then coupled and transmitted across a communication link connecting the transmitting facsimile with a receiver. Once a document is processed, the document is deleted from memory. If one or more pages of the document fail to correctly arrive at the

- 2 -

receiver, the pages must be rescanned and retransmitted. If a user wishes to transmit the same document at a future time, the document must again be rescanned before transmission. Other systems include a memory which stores multiple pages of documents in a queue as the documents are scanned. The documents are transmitted typically in a first-in first-out manner. Once transmitted, the document is deleted from the memory. Likewise, when a document is received by the facsimile, it is temporarily stored in memory until the document is printed. Once printed, the document is deleted from the memory to make the resources available for the next document.

The present invention provides a multi-functional document processing machine having a document storage subsystem which overcomes the above-referenced problems and others.

Summary of the Invention

In accordance with the present invention, a new and improved method and apparatus for operating a multi-functional document processing system is provided. The multi-functional document processing system includes at least a facsimile transmitter and receiver subsystem, a scanner subsystem, and a printer subsystem. A plurality of functions are performed by the subsystems including transmitting and receiving facsimile data, scanning documents, printing documents, and copying documents. A document storage subsystem stores each document generated by the subsystems. Each document is maintained in storage allowing a user to retrieve and process a selected document a multiple number of times in the future. A control processor controls the subsystems of the multi-functional document processing system to perform the plurality of functions.

In accordance with a more limited aspect of the present invention, the multi-functional document processing system includes a computer interface for providing

SUBSTITUTE SHEET (RULE 26)

- 3 -

communication between the control processor and an external computer or computer network. The computer interface allows the user to access the document storage subsystem through the external computer, request operations to be performed, and upload and download documents. Documents downloaded from the external computer are stored in the document storage.

In accordance with a more limited aspect of the present invention, the multi-functional document processing system includes a plurality of control processors each responsible for operating one of the subsystems.

One advantage of the present invention is that generated documents are stored and managed in a document memory for future processing.

Another advantage of the present invention is that documents are maintained in storage after they are processed in accordance with a user request and are accessible from storage for future requests.

Still further advantages of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the following detailed description of the preferred embodiments.

Brief Description of the Drawings

The invention may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating a preferred embodiment and are not to be construed as limiting the invention.

FIGURE 1 is a system block diagram of the present invention; and,

FIGURE 2 is a hardware implementation of the multi-functional document processing system in accordance with the present invention.

- 4 -

Detailed Description of Preferred Embodiments

With reference to FIGURE 1, a multi-functional document processing system has a document feeder 10 which receives documents as input. A document scanner 12 produces digital signals representative of the inputted document. A line interface 14 is connected to a facsimile subsystem 16. The facsimile subsystem includes a transmitter and receiver for transmitting and receiving text, image, and voice data across the line interface 14 to a remote device. A control processor 18 processes the digital signals in accordance with a user request inputted through a human interface 20. The user request can designate one or more operational modes of the multi-functional document processing system. The operational modes include transmitting and receiving facsimile data, scanning, uploading and downloading to a computer, copying, and printing by a printer 22. Other operations will be apparent from reading this disclosure.

A document storage subsystem 24 stores each document generated by the operational modes. The stored documents are maintained in the storage 24 to allow a user to retrieve and process a selected document more than once. The stored documents are accessible to users for future processing. Documents are stored in a variety of forms including text, image, voice, video, or any combination thereof. The user request can designate multiple operations to be performed on a selected document.

The computer interface 26 provides a data path between the control processor 18 of the multi-functional document processing system and a computer or a network of computers. The data is carried over a communications carrier medium 28 such as a parallel cable, a serial cable, a wireless channel, a local area network, a wide area network, a token ring, or any other carrier medium which is known to those of ordinary skill in the art. A user operating a computer connected with the computer interface 26 can control the multi-functional document processing

- 5 -

system as a PC printer, PC scanner, PC fax, copier, and transfer documents to and from the document storage subsystem 24. In accordance with a user command, the control processor 18 generates a list of documents stored in the document storage subsystem 24. The user can select a desired document and request one or more operations to be performed by the multi-functional document processing system. The user can also download a PC-based document to be transmitted, printed, stored, or any combination of operations. Alternately, more than one interface is provided.

The document scanner 12, the facsimile 16, and the computer interface 26 are document generator subsystems in which a document may originate. The control processor 18 includes means for storing documents in the document storage subsystem 24 as the documents are generated by one of the document generator subsystems. The means for storing include dedicated circuits, chips, software, or any combination of circuits, chips and software. The facsimile 16, the printer 22, and the computer interface 26 are document consumer subsystems since they perform outputting functions.

In the preferred embodiment, the document storage subsystem 24 includes dynamic random access memory (dynamic RAM) to store documents. Alternatively, other types of memory devices such as erasable electronically programmable read only memory (EEPROM), bubble memory, external storage, holographic memory, and other variations of random access memories can be used. When a document is generated by one of the generator subsystems, the control processor 18 transfers the document to the document storage subsystem. The document storage subsystem 24 assigns an identification code, such as a document number, to each document and stores the document. Each document is maintained in storage after the document is processed. The user can retrieve a selected document from the document storage 24 any number of times and process the selected document by

- 6 -

any of the functions. For example, a document is received by the facsimile 16. The document is stored in the document storage 24 and the document is printed. Two hours later, the document is selected and retrieved from storage 5 24 and transmitted to a remote device. The next day, the document is selected and retrieved from the storage 24 for printing and uploading to a computer, etc.

With reference to FIGURE 2, the document storage subsystem 24 includes a compression/expansion processor 30, 10 a dynamic RAM controller 32, and a document memory 34. The compression/expansion processor 30 compresses and decompresses data according to the CONSULTATIVE COMMITTEE FOR INTERNATIONAL TELEPHONE AND TELECOMMUNICATIONS (CCITT) standards of MMR format, MH format, and MR format. 15 Alternatively, software may be used to compress and expand data without a dedicated processor. A DMA controller 36 controls the transferring of original and compressed bit map images between the compression/expansion processor 30 and a dynamic RAM 38. Dynamic RAM 38 stores variables and 20 document lists. Alternatively, other types of memory such as cache and other variations of random access memories can be used as known to one of ordinary skill in the art.

The user can access the documents stored in the document memory 34 a multiple number of times using the 25 human interface 20 or through the computer interface 26 using a connected computer. The control processor 18 includes means for controlling communications between the document storage subsystem 24 and the user. The control processor 18 includes accessing means which allows the user 30 to select documents from the document memory 34 and assign attributes and parameters to the documents such as requesting one or more operations to be performed with the document. The controlling means and the accessing means 35 include circuitry, chips, dedicated processors, software, or any combination of these. The control processor then executes the requests.

SUBSTITUTE SHEET (RULE 26)

- 7 -

The document storage subsystem 24 marks documents for deletion when the operations associated with the document are completed but the document is not deleted at this time. The documents are maintained in storage.

5 Alternatively, documents are also marked for deletion when its operation is unable to be performed. A user can designate a document as being a permanent document in which case the document is never marked for deletion.

10 In the preferred embodiment, once the document memory 34 does not contain enough storage capacity to store a new document, the control processor 18 initiates deletion commands to the document storage subsystem 24. Documents which are marked for deletion are deleted according to a predetermined priority schedule until enough space is
15 created for the new document. The priority schedule is a first-in first-out schedule, a best fit schedule, or any other schedule known to those of ordinary skill in the art. Alternately, other conditions can initiate the deletion process as a substitute for the lack of store capacity
20 condition. These include a direct delete command, age of a document, and any other condition known to one of ordinary skill in the art.

The facsimile subsystem 16 includes a transmitting and receiving modem 40, analog switches 42 and
25 44, a microphone 46, a speaker 48, and a telephone line interface circuit 50. The modem 40 converts facsimile data, binary data, voice data, and other types of data from analog signals to digital signals and vice-versa. The modem receives analog voltages at an analog input 52. When
30 signals of specified frequencies and amplitudes are detected at the analog input 52, the control processor 18 is notified and begins control of receiving data from the modem 40. The received data is simultaneously stored in the document memory 34 as a document. The analog switches
35 are controlled by the control processor 18 and a general IO circuit 56. The microphone 46 records audible signals. The modem 40 converts the audible signals to digital

SUBSTITUTE SHEET (RULE 26)

- 8 -

signals. The control processor 18 stores the digital signals as a document in storage 24. The speaker 48 plays back the recorded digital signals, as is known in the art, upon a request.

5 The human interface 20 includes panel keys 58, panel LEDs 60, and a liquid crystal display 62 (LCD). The control processor 18 controls and communicates with the human interface through a panel interface 62. The human interface 20 is disposed on an exterior portion of the multi-functional document processing system where it is visible and accessible to the user. The user inputs information to the system through the panel keys 58 and the system provides information to the user through the panel LEDs 60 and the liquid crystal display 62. The user can review a list of documents stored in the document memory 34 and select a desired document for instant or future transmission, printing, copying, uploading, downloading, deletion, or any combination of operations.

15 The user manually inputs a document to the multi-functional document processing system using the scanner subsystem 12. Pages of the document are deposited in the document feeder 10 which feeds the document page by page to the document scanner 12. The scanner subsystem 12 includes a contact image sensor 64, a video interface 66, a motor 68, and a driver 70 as are known to those of ordinary skill in the art. When the document is scanned, the control processor 18 also transfers the document to the document storage subsystem 24 where it is compressed, assigned an identification code, and stored in the document memory 34. The scanned document is then available for further processing in accordance with the user's request.

25 The printer 22 includes a printing engine 72 and a printing engine controller 74. The printing engine 72 records images on paper using known printing technology including laser and inkjet technology. The control processor controls the laser printing engine by communicating with the laser printing engine controller.

SUBSTITUTE SHEET (RULE 26)

- 9 -

An image scaler 76 reduces and enlarges document image sizes if necessary for printing.

A power supply 78 generates power for the multi-functional system. The power supply converts AC line voltage into various voltages required by the electrical and electromechanical components of the system.

Other subsystems can be included in the document processing system such as a video recording and playback subsystem. Recorded video signals are stored in the document storage 24 just like a typical document. The stored video signals are then accessible for processing.

In the preferred embodiment, a portion of the document memory 34 is permanently reserved for documents received by the facsimile subsystem 16. This prevents the user from exhausting document memory 34 with local documents or transmit documents which will prohibit the successful reception of documents by the facsimile receiver.

The following operations are described with reference to FIGURES 1 and 2. Many other operations are of course possible which would be known to one of ordinary skill in the art from reading the disclosure.

In a transmission operation, the facsimile 16 which includes a transmitter and receiver, modulates digital signals corresponding to a document into an analog format compatible with an external communication carrier medium connected to the line interface 14. The digital signals of the document are obtained through a simultaneous scanning of the document by the scanner subsystem 12, retrieved from the document storage subsystem 24 as a stored document, or received from a connected computer through the computed interface 26. If the document is generated by the scanner or connected computer, the control processor 18 stores the generated document into the document storage subsystem 24. Once a communication link is established with a predetermined remote device, the document transmitted by the modem 40. Once transmission is

SUBSTITUTE SHEET (RULE 26)

- 10 -

complete, a copy of the document is maintained in the document storage subsystem 24.

In a receiving operation the facsimile 16 receives analog signals representing a document from the communication carrier medium and demodulates the analog signals into corresponding digital signals. The control processor 18 stores the digital signals as a document in the document storage subsystem 24 and the printer 22 is initiated to print the document. When printing is complete, the document is maintained in the document storage 24.

In a printing operation, the printer 22 converts received digital data of a selected document into a visual image on paper or other substances as known to those of ordinary skill in the art. The control processor 18 includes means to control the printer 22 in accordance with a user request and the origin of the selected document. The selected document may be generated by the facsimile receiver after being received from a remote location, the document may be generated by the scanner 12, generated from a computer through the computer interface 26, or retrieved from the document storage subsystem 24.

In a copying operation requested by the user, the user inputs a document into the document feeder 10. The scanner 12 scans the document and generates electrical signals representative of the document. The control processor 18 stores the document into the document memory 34. The document then printed by the printer 22.

In an alternative embodiment, the document storage subsystem 24 archives documents marked for deletion in an attached computer system before the documents are deleted. If the user wishes to add attributes and parameters to an archived document and if the archived document has been deleted from document memory, the control processor 18 will retrieve the document from the archiving computer.

- 11 -

The invention has been described with reference to the preferred embodiment. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is
5 intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

SUBSTITUTE SHEET (RULE 26)

- 12 -

Having thus described the preferred embodiment, the invention is now claimed to be:

1. A document processing system including a facsimile subsystem for transmitting and receiving facsimile data, a printer subsystem for converting data into a visual image, and a scanner subsystem for converting
5 a visual image into equivalent electronic signals, comprising:

a document storage subsystem for storing documents as the documents are generated by one of the subsystems; and

10 a control processor being in data communication with the facsimile subsystem, the printer subsystem, the scanner subsystem, and the document storage subsystem, the control processor being adapted to access and retrieve a selected document stored in the document storage system a
15 plurality of times, and process the selected document by at least one user request each time the selected document is retrieved.

2. The document processing system as set forth in claim 1 wherein the document storage subsystem is adapted to store documents including at least one of text data, image data, and voice data.

3. The document processing system as set forth in claim 1 further including a computer interface subsystem in data communication with the control processor and an external computer, the computer interface is adapted to
5 transfer documents between the document storage subsystem and the external computer.

4. The document processing system as set forth in claim 1 wherein the document storage subsystem includes a means for deleting the documents stored when the document storage subsystem has a free storage capacity which is

SUBSTITUTE SHEET (RULE 26)

- 13 -

5 insufficient to store a new document, the means for deleting deletes the documents stored in accordance to a predetermined schedule.

5. The document processing system as set forth in claim 1 further including a sound recording means for recording voice data and storing the voice data in the document storage subsystem; and

5 a sound playback means for converting the voice data stored in the document storage subsystem into audible signals.

6. A method of operating a document processing system having a plurality of functions including transmitting and receiving facsimile documents, printing documents, and scanning documents, comprising:

5 storing documents as the documents are generated by one of the plurality of functions;

retrieving a selected document a plurality of times from the documents stored, each retrieving occurring at a different point in time; and

10 processing the selected document after each time of retrieving in accordance with at least one user request.

7. The method of operating a document processing system as set forth in claim 6 wherein the processing includes at least one of transmitting the selected document by facsimile, and printing the selected document.

8. The method of operating a document processing system as set forth in claim 6 wherein the storing includes storing a document received from an external computer in data communication with the document processing system.

SUBSTITUTE SHEET (RULE 26)

- 14 -

9. The method of operating a document processing system as set forth in claim 8 wherein the processing includes at least uploading the selected document to the external computer, and downloading another document from the external computer.

10. A method of operating a document processing system having a plurality of functions including transmitting and receiving facsimile documents, printing documents, and scanning documents, comprising:

5 storing documents as the documents are generated by one of the plurality of functions;

in response to a first user request, retrieving a selected document from the stored documents and processing the selected document in accordance with the first user request, wherein the selected document is maintained in storage after the processing; and

10 in response to a second user request, retrieving the selected document from the stored documents and processing the selected document in accordance with the second user request, wherein the first and second user requests occur at different times.

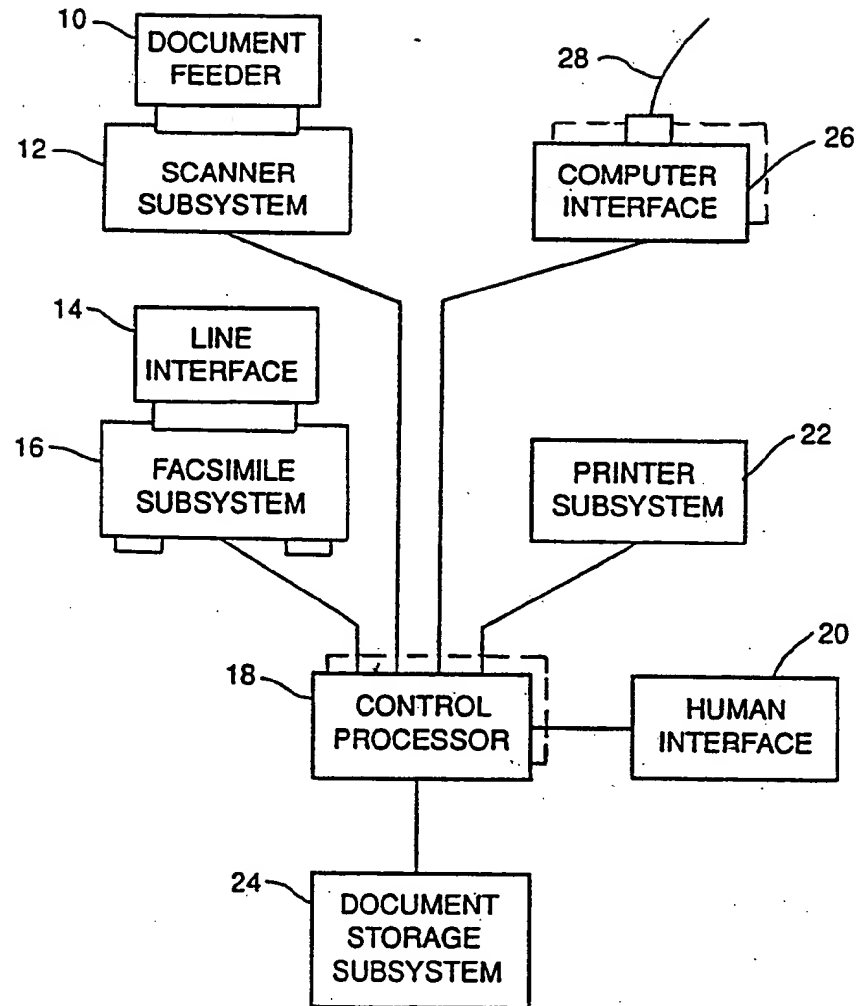


FIG. 1

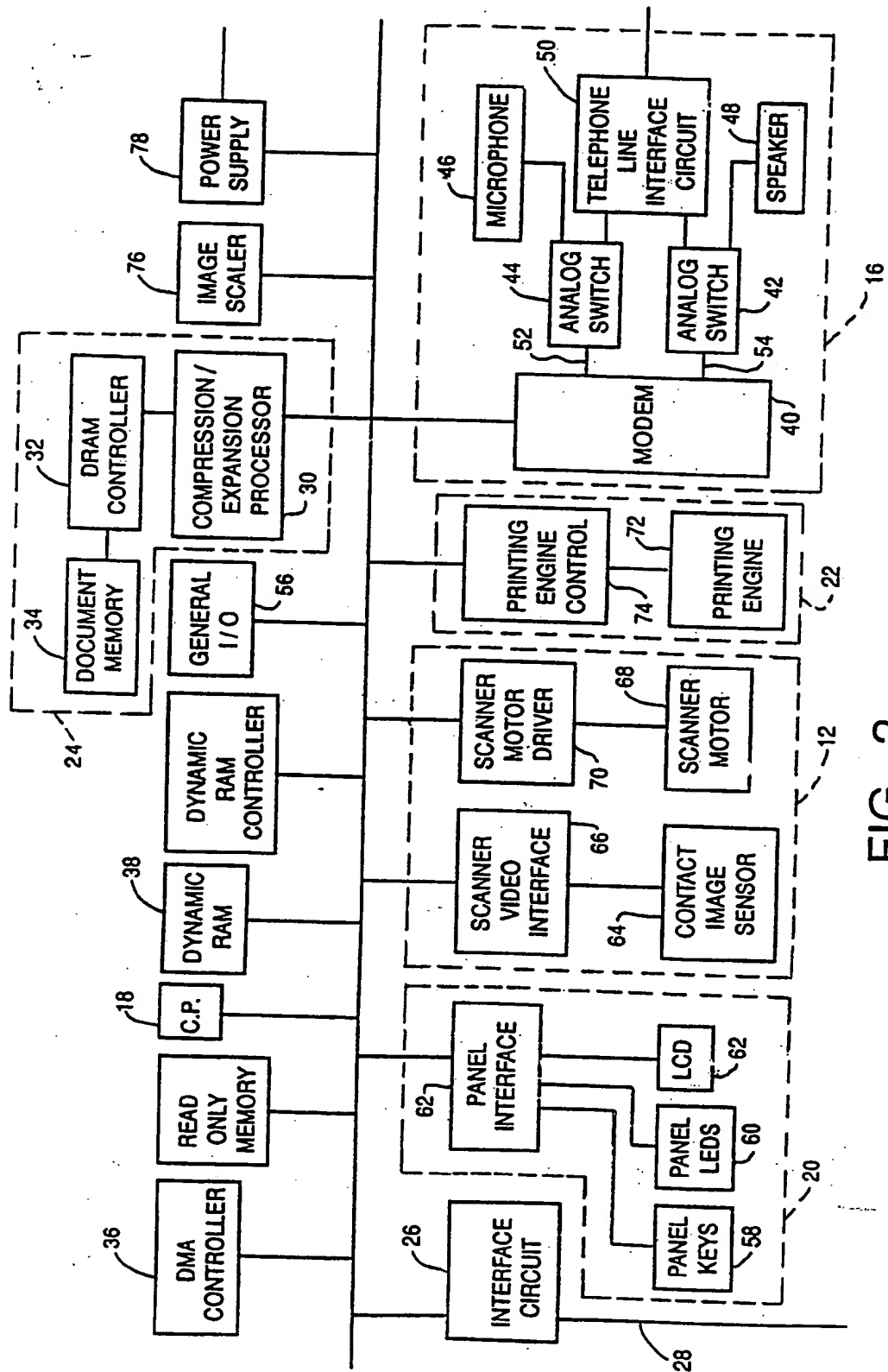


FIG. 2

INTERNATIONAL SEARCH REPORT

Intern. Application No
PCT/GB 95/00895

A. CLASSIFICATION OF SUBJECT MATTER IPC 6 H04N1/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 6 H04N		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US-A-5 091 790 (SILVERBERG MORTON) 25 February 1992	1,6,10
A	see the whole document	2-5,7-9
Y	WO-A-93 22870 (LINDG ANGSTROM RD LENNART B) 11 November 1993	1
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Date of the actual completion of the international search 2 August 1995		Date of mailing of the international search report 07.08.95
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International Application No.
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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